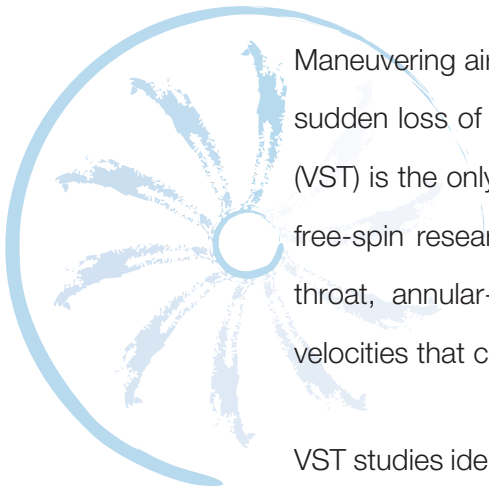


NASA's Aeronautics Test Program

20-Foot Vertical Spin Tunnel



Maneuvering aircraft may encounter a dangerous condition known as spin, caused by a sudden loss of lift over wings or control surfaces. NASA's 20-Foot Vertical Spin Tunnel (VST) is the only operational tunnel of its kind in the Western Hemisphere that conducts free-spin research using dynamically scaled, free-flying models. The VST is a closed-throat, annular-return facility that operates at nominal atmospheric conditions, with velocities that can be rapidly adjustable up to 85 ft per sec.

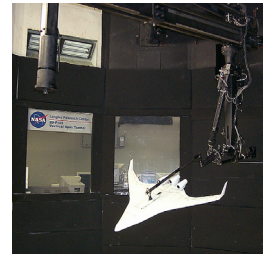
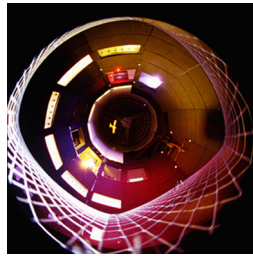
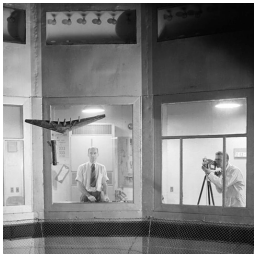
VST studies identify and quantify spin and spin-recovery characteristics of a given vehicle configuration. Related tumbling research identifies susceptibility to out-of-control pitch autorotation and strategies for safe recovery. Forced-oscillation capability has recently

been added to the tunnel's rotary balance in order to measure body-axis rate-damping characteristics.

The VST has supported the development of nearly all U.S. military fighter and attack airplanes, trainers and bombers, as well as some foreign designs. It is the only resource available to commercial aircraft manufacturers for proprietary spin-and-tumble assessments of their products in a wind tunnel environment.



Orion Launch Abort System model being tested in the VST.



Facility Benefits

- A variety of miscellaneous instruments, including hand-held anemometers, force gauges, electronic levels, and digital volt meters are available to users
- Direct observation of tests is available through panoramic control-room windows
- Recording views of models and the test section during tunnel operation is possible using in situ S-VHS or digital video cameras, time-code generators, and recording media

Characteristics

Test section dimensions	25 ft high by 20 ft wide
Area	300 ft ²
Speed	Mach 0.08
Reynolds number	0.55×10^6 per ft
Pressure	Atmospheric
Temperature	Ambient
Test gas	Air
Contraction area ratio	5:1
Drive power	400 hp continuous and 1300 hp in short bursts

Data Acquisition and Processing

Inputs	Analog balance voltages, digital model altitude, and electronically scanned pressure (ESP) system
Controller	Proprietary and Open Architecture Data Acquisition Systems (OADAS)
Capacity/channels	Analog/128, Digital/32, and ESP/2048
Dynamic data acquisition	Yes
Classified capability	Yes

Facility Applications

- Spin mode analysis, identification of recovery control strategies, and emergency spin-recovery parachute sizing are accomplished in the VST. Nearly all U.S. high-performance fighter, attack, and trainer aircraft, as well as some bombers, foreign designs, small parachutes, and several general aviation aircraft have been tested at the VST.
- The VST has provided key subsonic, dynamic stability data for many non-crewed and human-rated atmospheric entry vehicles. Examples include Pioneer Venus, Stardust, and Mars Sample Return prototypes and the Mercury, Gemini, and Apollo space capsules.
- Most recently, the VST is contributing to development of NASA's Orion crew exploration vehicle with subsonic dynamic stability assessments of the Orion Launch Abort Vehicle and crew module, drogue parachute performance, and rotary balance studies of the Blended Wing Body and ARES Mars Airplane configurations.

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